

CHEMICALS

Project Fact Sheet



MEMBRANES FOR REVERSE-ORGANIC AIR SEPARATIONS

BENEFITS

- Potential to save 180 million gallons of gasoline per year domestically
- Reduces VOC fugitive emissions to below the proposed California Air Resources Board limit of 0.38 lb/month/1000 gallon capacity for gasoline stations

APPLICATIONS

Several industrial applications require membranes that retain VOCs at high pressure. Project partners have primarily focused on VOCs from underground storage tanks at gas stations. Other potential applications include: chemical and pharmaceutical processes, tobacco reforming processes, fuel oil tank farm storage, and paint shop venting.

MEMBRANE UTILIZES REVERSE SEPARATION TO REDUCE EMISSION OF POLLUTANTS

Many industrial applications are in need of a process to separate pollutants known as volatile organic compounds (VOCs) from air in order to protect the environment and save energy. One such application is the venting of vapors from underground storage tanks (UST) used at gasoline dispensing facilities. These vapors, which build-up and create high pressure within the UST, contribute to ground-level ozone and smog. Ideally, a membrane could be used to relieve internal tank pressure by preferentially releasing air into the atmosphere while retaining the VOCs. However, traditional separation of VOCs using rubbery polymer membranes is inadequate for this application since they permeate VOCs more rapidly than air. To address this shortcoming, project partners are developing a membrane system that reverses the typical rubbery polymer membrane separation by discharging clean air at low pressure while keeping the VOCs behind.

In addition to recovering the fugitive emissions from the storage tank, the developed system will allow the UST and its associated piping to operate at a negative pressure while providing constant diagnostics of the refueling system, ensuring no leaking within the system. It is critical that the membrane work by transmitting the air and retaining the organic compounds. This separation function enables storage facilities to operate at a slight vacuum with continuous monitoring.

REVERSE SEPARATION SYSTEM



Membrane system uses reverse separation to maintain underground fuel tanks under vacuum and to control gasoline vapor emissions.



Project Description

Goal: The goal of this project is to develop a single-stage reverse separation membrane system that can drastically reduce the VOC emissions from underground storage tanks and thereby dramatically reduce loss of gasoline due to fugitive emissions. A secondary objective will be to demonstrate for the first time a reverse separation membrane used for high transmission of air over organics in a gas separation application.

Progress and Milestones

Early research successfully demonstrated that the reverse separation process was ideally suited to keep the VOCs behind at atmospheric pressure.

Current research is focused on accomplishing the following milestones:

- Customize/optimize membrane module development
- Optimize the system as a whole, including the blower, vacuum pump, motor, and hollow fiber dimension and length
- Build reverse separation membrane-based system
- Evaluate hybrid system options for operations requiring ultraclean vent streams
- Test hybrid system in a field-unit application

Commercialization

Veeder-Root will combine the developed system with their extensive In-Station Diagnostics offerings and will oversee installation onto gasoline station sites. Vapor Systems Technologies (VST) will manufacture the system. Compact Membrane Systems, Inc. (CMS) will manufacture the membranes and explore new applications for the technology. Patent rights to the system and the membranes are controlled by VST and CMS.



PROJECT PARTNERS

Compact Membrane Systems, Inc.
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Praxair, Inc.
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